

WHAT IS CLAIMED IS:

1. A method for radix-2 fast fourier transform on a digital series to produce signals in cyclically noncontinuous output bins, comprising the steps of:

5 determining the number 2^S of FFT points, the output bin index O_S , and the input signal array;

determining the butterfly index for the last stage by

$$\Psi_{S-1} = O_S \% \left(\frac{N}{2} \right) \quad (9)$$

10 determining the butterfly index for each stage other than said last stage by

$$\Psi_{\ell-1} = \Psi_{\ell} \% \left(\frac{N}{2^{S-\ell+1}} \right) \quad (10)$$

where ℓ varies from 1 to (S-1);

15 using said butterfly index, calculating only those butterflies necessary for calculation of the output bins.

2. A method according to claim 1, wherein said step of determining the butterfly index for all later stages is performed in numerical order.

3. A method according to claim 2, wherein said numerical order is ascending order.

4. A method according to claim 1, further including the determination of output bins by the additional steps of:

for stage ℓ , where ℓ varies from 1 to S, executing only that butterfly in the butterfly index set $\Psi_{\ell-1}$ of that stage;

5 for stage ℓ , loading the twiddle factor corresponding to the butterfly index set $\Psi_{\ell-1}$ of that stage; and

repeating the steps of (a) executing only that butterfly in the butterfly index set $\Psi_{\ell-1}$ of that stage and (b) loading the twiddle factor corresponding to the butterfly index set $\Psi_{\ell-1}$ of that stage, until
10 the required final stage butterflies are executed and the required output bins are filled.

5. A method according to claim 1, wherein said step of using said butterfly index includes the further steps of:

setting the butterfly index set Ψ_j where $(1 \leq j \leq S-1)$ and the selected output node index set ranges from O_s to M_s^j by

5 (a) for $(1 \leq j \leq S-1)$

(i) if $(k \in \Psi_j)$ or Ψ_j contains index k, then setting $m_j^k = 1$.

(ii) if $(k \in \Psi_j)$, then setting $m_j^k = 0$.

(b) for $j = S$

10 (i) if $(k \in O_s)$, or O_s contains index k, then setting $m_j^k = 1$.

(ii) if $(k \notin O_s)$, then setting $m_j^k = 1$; and

Controlling of a memory pair stage j by m_j^i ($0 \leq i \leq 2^{j-1}-1$) and m_j^{i+Y} , ($Y = 2^{j-1}$).

6. A method according to claim 4, wherein said step of setting the butterfly index includes the steps, when $0 \leq i \leq (2^{j-1}-1)$, of:

- 5 controlling the butterfly adder with m_j^i ;
 controlling the butterfly subtractor with m_j^{i+Y} ; and
 controlling the butterfly multiplier in accordance with
the Boolean OR of m_j^i and m_j^{i+Y} .